ACADEMIC REGULATIONS
PROGRAM STRUCTURE
and
DETAILED SYLLABUS

Master of Technology
(Power Systems)

(Two Year Regular Programme)
(Applicable for the Batches admitted from 2014)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

Gokaraju Rangaraju
Institute of Engineering and Technology, Hyderabad
M. Tech. GR14 Regulations

Gokaraju Rangaraju Institute of Engineering & Technology 2014 Regulations (GR14 Regulations) are given hereunder. These regulations govern the programmes offered by the Department of Electrical and Electronics Engineering with effect from the students admitted to the programmes in 2014-15 academic year.

1. **Programme Offered:** The programme offered by the Department is M.Tech in Power Systems, a two-year regular programme.

2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

3. **Admissions:** Admission to the M.Tech in Power Systems Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the Institute/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in PGECET conducted by the APSCHE for M. Tech Programmes or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

4. **Programme Pattern**
   a) Each Academic year of study is divided into two semesters.
   b) Minimum number of instruction days in each semester is 90.
   c) The total credits for the Programme is 88.
   d) All the registered credits will be considered for the calculation of the final percentage of marks.

5. **Award of M.Tech Degree:** A student will be declared eligible for the award of the M. Tech Degree if he/she fulfills the following academic requirements:
   a) A student shall be declared eligible for the award of M.Tech degree, if he/she pursues the course of study and completes it successfully in not less than two academic years and not more than four academic years.
   b) A Student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the date of admission, shall forfeit his/her seat in M.Tech course.
   c) The Degree of M.Tech in Power Systems shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. Attendance Requirements

a) A student shall be eligible to appear for the end semester examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) Students who have been granted condonation shall pay a fee as decided by the Academic Council.

d) A candidate shall get minimum required attendance at least in three (3) theory subjects in the semester to get promoted to the next semester. In order to qualify for the award of M.Tech Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re-registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment

a) Paper setting and Evaluation of the Answer Scripts shall be done as per the procedures laid down by the Academic Council of the College from time to time.

b) The following is the division of marks between internal and external evaluations.

Particulars	Internal	External	Total
Theory	40	60	100
Practical	40	60	100
Comprehensive Viva	--	100	100
Seminar	50	----	50
Project Work	Grade	-----	----
Project work & dissertation (Grading System)	------	Grade	----

c) Continuous Internal Evaluation and Semester End Examinations

The assessment of the student's performance in each course will be based on continuous internal evaluation and semester-end examinations. The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure

S.No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	40	Internal Exams & Continuous Evaluation	1. Mid-examinations: … 30 Marks (Two mid-semester examinations shall be conducted for 30 marks each for duration of 2 hours. Average of the two mid semester examinations shall be considered) 2. Tutorial: … … 5 Marks 3. Attendance: .. 5 Marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours
2	Practical	40	Internal Exams & Continuous Evaluation	1) Lab Internal :15 marks 2) Record : 5 marks 3) Continuous Assessment : 15 marks 4) Attendance : 5 marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours.

d) Comprehensive Viva: There shall be a Comprehensive Viva-Voce in II Year I semester. The Comprehensive Viva-Voce will be conducted by the committee consisting of Head of the Department and two senior faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the student's understanding in various subjects he/she studies during the M.Tech course of study. The Comprehensive Viva-Voce is valued for 100 marks by the committee. There are no internal marks for the Comprehensive Viva-voce.

e) Seminar: There shall be three Seminar Presentations by the student, one each in the I,II and III semesters. For the seminar, the student shall collect the information on a specialized topic other than his/her project and prepare a technical report, showing his understanding over the topic, and

submit to the department, which shall be evaluated by a Departmental committee consisting of the Head of the department, seminar Supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

f) Project: The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters (III & IV). Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Project Review Committee (PRC).
   i) PRC shall be constituted with HOD as chair person, two senior faculty members and project supervisor.
   ii) Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).
   iii) A candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the PRC for its approval. Only after obtaining the approval of PRC the student can initiate the Project work.
   iv) If a candidate wishes to change his supervisor or topic of the project he/she can do so with approval of PRC. However, the PRC shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of supervisor or topic as the case may be.
   v) Project Work: The candidate should be continuously observed by the project supervisor. His performance is assessed by the PRC through a seminar and interim report. Full credits are awarded 'SAT' on satisfactory performance of the student. 'US' grade is given on unsatisfactory performance. If the performance is unsatisfactory, the PRC should redefined the project and the candidate is allowed to appear for the evaluation only after six months.
   vi) Project Work & Dissertation: A candidate shall submit status report (in a bound-form) in two stages at least with a gap of 3 months between them to the project supervisor.
   vii) A candidate is permitted to submit Project dissertation only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of dissertation to the Head of the Department and shall make an oral presentation before the PRC along with project supervisor.
   viii) Student has to submit to the department three copies of the Project dissertation along with a soft copy on CD certified by the supervisor.
   ix) The dissertation shall be adjudicated by one examiner selected by the Controller of examination from the panel of 3 examiners as suggested

by Head of the Department, who are eminent in that field with the help of the concerned guide and head of the department.

x) If the report of the Examiner is not favorable, the candidate shall revise and resubmit the dissertation, in the time frame as described by PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

xi) If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the dissertation. The Board shall jointly report candidates work as:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination.

If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he/she fails to get a satisfactory report at the second viva-voce examination, he/she will not be eligible for the award of the degree.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for re-counting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluationof his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Academic Requirements**

a) A student shall be deemed to have secured the minimum academic requirements in a subject if he / she secures a minimum of 40% of marks in the Semester-end Examination and a minimum aggregate of 50% of the total marks in the Semester-end examination and Internal Evaluation taken together.

b) In order to qualify for the award of M.Tech Degree, the student shall complete the academic requirements of passing in all the Courses as per

the course structure including Seminars and Project if any.

c) In case a Student does not secure the minimum academic requirements in any course, he/she has to reappear for the Semester-end Examination in the course, or re-register for the same course when next offered or re-register for any other specified course, as may be required. However, one more additional chance may be provided for each student, for improving the internal marks provided the internal marks secured by a student are less than 50% and he/she failed finally in the course concerned. In the event of taking another chance for re-registration, both the internal and external marks obtained in the previous attempt are nullified. In case of re-registration, the student has to pay the re-registration fee for each course, when next offered.

13. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of M. Tech Degree by JNTUH, he/she shall be placed in one of the following three classes:

Class Awarded	% of Marks Secured
First Class with Distinction	Marks ≥ 70%
First Class	60% ≤ Marks < 70%
Second Class	50% ≤ Marks < 60%

14. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he/she will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. **Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered eligible for re-registration to the same or equivalent subjects as and when they are offered.

17. General Rules

a) The academic regulations should be read as a whole for the purpose of any interpretation.

b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.

d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute/ University.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
M.TECH (Power Electronics)

PS - M.Tech - I Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5058	Advanced Power System Analysis	3	40	60	100
PC	GR14D5059	Advanced Power System Protection	3	40	60	100
PC	GR14D5038	Modern Control Theory	3	40	60	100
PC	GR14D5060	Power System Dynamics	3	40	60	100
		Elective I	3	40	60	100
PE	GR14D5041	HVDC Transmission				
	GR14D5061	Distribution Automation				
	GR14D5042	Energy Conservation Systems				
		Elective II	3	40	60	100
PE	GR14D5044	Solar and Wind Energy				
	GR14D5062	Gas Insulated Systems(GIS)				
	GR14D5063	EHV AC Transmission				
LAB	GR14D5064	Power Systems Simulation Lab	2	40	60	100
SPW	GR14D5175	Seminar-I	2	—	—	—
		Total	**22**	**280**	**420**	**700**

PS - M.Tech- I Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5065	Voltage Stability	3	40	60	100
PC	GR14D5066	Power System Operation and Deregulation	3	40	60	100
PC	GR14D5049	Flexible AC Transmission Systems (FACTS)	3	40	60	100
PC	GR14D5050	Neural and Fuzzy Systems	3	40	60	100
		Elective III	3	40	60	100
PE	GR14D5051	Power Quality				
	GR14D5067	Electric Smart Grid				
	GR14D5068	High Voltage Engineering				
		Elective IV	3	40	60	100
PE	GR14D5069	Reactive Power Compensation and Management				
	GR14D5070	Power System Reliability				
	GR14D5048	Microcontrollers				
LAB	GR14D5071	Power Systems Lab	2	40	60	100
SPW	GR14D5176	Seminar-II	2	—	—	—
		Total	**22**	**280**	**420**	**700**

PE - M.Tech - II Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5178	Comprehensive Viva	2	—	100	100
SPW	GR14D5177	Seminar-III	2	50	—	50
SPW	GR14D5179	Project work	18	Grade		
		Total	**22**	**50**	**100**	**150**

PE - M.Tech - II Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5180	Project work and Dissertation	22	Grade		

I-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED POWER SYSTEM ANALYSIS

Course Code: GR14D5058 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
Admittance Model and Network Calculations, Branch and Node Admittances, Mutually Coupled Branches in YBUS , An Equivalent Admittance Network, Modification of YBUS , Network Incidence Matrix and YBUS , Method of Successive Elimination, Node Elimination, Triangular Factorization, Sparsity and Near Optimal Ordering.

Unit-II
Impedance Model and Network Calculations, the BUS Admittance and Impedance Matrices, Thevenin's Theorem and ZBUS ,Algorithms for building ZBUS Modification of existing ZBUS, Calculation of ZBUS elements from YBUS, Power Invariant Transformations, Mutually Coupled Branches in ZBUS.

Unit-III
Gauss Seidel method, N-R Method, Decoupled method, fast decoupled method, comparison between power flow solutions. DC load flow.

Unit-IV
ZBUS Method in Contingency Analysis, Adding and Removing Multiple Lines, Piecewise Solution of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis of DC Model, System Reduction for Contingency and Fault Studies.

Unit-V
Fault Analysis: Symmetrical faults-Fault calculations using ZBUS- Fault calculations using ZBUS equivalent circuits –Selection of circuit breakers-Unsymmetrical faults-Problems on various types of faults.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Book
1. John J.Grainger and W.D. Stevenson," Power System Analysis "-T.M.H.Edition.

Reference Books

1. Olle. L.Elgard, “Electrical Energy Systems Theory”-T.M.H.Edition.
2. Power systems stability and control, Prabha Kundur, The Mc Graw – Hill companies.
3. Power System Operation and Control, Dr. K. Uma Rao, Wiley India Pvt. Ltd.
4. Operation and Control in Power Systems, PSR Murthy, Bs Publications.
5. Power System Operation, Robert H. Miller, Jamesh H. Malinowski, The Mc Graw – Hill companies.
6. Power Systems Analysis, operation and control by Abhijit Chakrabarti, Sunitha Halder, PHI 3/e , 2010
7. Modern Power System Analysis – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hill PublishingCompany Ltd, 2nd edition.
8. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., cengage 3rd Edition.
9. Electric Energy systems Theory – by O.I.Elgerd, Tata Mc Graw-hill Publishing Company Ltd., Second edition.
10. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
11. Power System Analysis by C.L.Wadhwa, Newage International-3rd Edition

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED POWER SYSTEM PROTECTION

Course Code: GR14D5059 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Static Relays: Advantages of static relays-Basic construction of static relays-Level detectors-Replica impedance –Mixing circuits-General equation for two input phase and amplitude comparators-Duality between amplitude and phase comparators.

Amplitude Comparators: Circulating current type and opposed voltage type-rectifierbridge comparators, Direct and Instantaneous comparators.

Unit-II

Phase Comparators: Coincidence circuit type- block spike phase comparator, techniques to measure the period of coincidence-Integrating type-Rectifier and Vector product type- Phase comparators.

Static Over Current Relays: Instantaneous over-current relay-Time over-current relays-basic principles –definite time and Inverse definite time over-current relays.

Unit-III

Static Differential Relays: Analysis of Static Differential Relays –Static Relay schemes –Duo bias transformer differential protection –Harmonic restraint relay.

STATIC DISTANCE RELAYS: Static impedance-reactance–MHO and angle impedance relay-sampling comparator –realization of reactance and MHO relay using sampling comparator.

Unit-IV

Multi-input Comparators: Conic section characteristics-Three input amplitude comparator –Hybrid comparator-switched distance schemes –Poly phase distance schemes- phase fault scheme –three phase scheme – combined and ground fault scheme.

Power Swings: Effect of power swings on the performance of distance relays –Power swinganalysis-Principle of out of step tripping and blocking relays-effect of line and length and source impedance on distance relays.

Unit-V

Microprocessor Based Protective Relays: (Block diagram and flowchart approach only)-Over current relays–impedance relays-directional relay-reactance relay .Generalized mathematical expressions for distance relays-

measurement of resistance and reactance –MHO and offset MHO relays-Realization of MHO characteristics-Realization of offset MHO characteristics - Basic principle of Digital computer relaying.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Book

1. Badri Ram and D.N.Vishwakarma, “Power system protection and Switch gear “, TMH publication New Delhi 1995.

Reference Books

1. T.S.Madhava Rao , “Static relays”, TMH publication, second edition 1989.
2. Protection and Switchgear, Bhavesh Bhalja, R. P. Mahesheari, Nilesh G. Chothani, Oxford University Press.
3. Electrical Power System Protection, C. Christopoulos and A. Wright, Springer International.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MODERN CONTROL THEORY

Course Code: GR14D5038 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Math Tical Preliminaries: Fields, Vectors, Vector Spaces-Linear combinations and Bases-Linear Transformations and Matrices-Scalar Product and Norms, Eigen values, Eigen Vectors and a Canonical form representation of linear operators, The concept of state-State Equations for Dynamic systems, Time invariance and Linearity Non uniqueness of state model-State diagrams for Continuous-Time State models.

Unit-II

State Variable Analysis: Linear Continuous time models for Physical systems-Existence and Uniqueness of Solutions to Continuous- time State Equations-Solutions of Linear Time Invariant Continuous-Time State Equations-State transition matrix and it's properties. CONTROLLABILITY AND OBSERVABILITY: General concept of controllability-General concept of Observability-Controllability tests for Continuous-Time Invariant Systems-Observability tests for Continuous-Time Invariant Systems-Controllability and Observability of State Model in Jordan Canonical form-Controllability and Observability Canonical forms of State model.

Unit-III

Non-Linear Systems-I: Introduction to Non Linear Systems - Types of Non-Linearity's-Saturation-Dead-Zone - Backlash Jump Phenomenon etc;- Singular Points-Introduction to Linearization of nonlinear systems, Properties of Non Linear systems-Describing function-describing function analysis of nonlinear systems-Stability analysis of Non-Linear systems through describing functions

Non Linear Systems-II: Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase- plane analysis of nonlinear control systems.

Unit-IV

Stability Analysis: Stability in the sense of Lyapunov, Lyapunovs stability and Lyapunov's instability theorems-Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method-Generation of Lyapunov functions Variable gradient method-Krasooviski's method.

State Feedback Controllers and Observers: State feedback controller design through Pole Assignment-State observers: Full order and Reduced order.

Unit-V

Optimal Control: Introduction to optimal control - Formulation of optimal control problems-calculus of variations-fundamental -concepts, functionals, variation of functional-fundamental theorem of Calculus of variations-boundary conditions-constrained minimization-formulation using Hamiltonian method-Linear Quadratic regulator.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. Modern Control System Theory by MGopal — New Age International - 1984
2. Modern Control Fngineering by Ogata:K — Prentice Hall – 1997

Reference Book

1. Optimal control by Kircks.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

POWER SYSTEM DYNAMICS

Course Code: GR14D5060 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
Basic Concepts: Power system stability states of operation and system security - system dynamics - problems system model analysis of steady State stability and transient stability - simplified representation of Excitation control.

Unit-II
Modeling of Synchronous Machine: Synchronous machine - park's Transformation-analysis of steady state performance per - unit quantities-Equivalent circuits of synchronous machine-determination of parameters of equivalent circuits.

Unit-III
Excitation System: Excitation system modeling-excitation systems block Diagram - system representation by state equations- Dynamics of a synchronous generator connected to infinite bus - system model Synchronous machine model-stator equations rotor equations - Synchronous machine model with field circuit - one equivalent damper winding on q axis (model 1.1) - calculation of Initial conditions.

Unit-IV
Analysis of Single Machine System: Small signal analysis with block diagram - Representation Characteristic equation and application of Routh Hurwitz criterion- synchronizing and damping torque analysis-small signal model - State equations.

Unit-V
Application of Power System Stabilizers: Basic concepts in applying PSS - Control signals - Structure and tuning of PSS - Washout circuit - Dynamic compensator analysis of single machine infinite bus system with and without PSS.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Book

1. K.R. PADIYAR," Power system dynamics "- B.S. Publications.

Reference Books

1. P.M. Anderson and A.A. Fouad,"Power system control and stability ",IEEE Presss
2. R. Ramanujam, "Power Systems Dynamics"- PHI Publications.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
HIGH VOLTAGE DC TRANSMISSION

Course Code: GR14D5041 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
H.V.D.C. Transmission: General consideration, Power Handling Capabilities of HVDC Lines Basic Conversion principles, static converter configuration.

Unit-II
Static Powcr Converters: 3-pulse,6-pulse and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter-special features of converter transformers. Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

Unit-III
Control of Hvdc Converters and Systems: Constant current, constant extinction angle and constant Ignition angle control Individual phase control and equidistant firing angle control DC power flow control. Interaction between HVAC and DC systems-Voltage interaction Harmonic instability problems and DC power modulation.

Unit- IV
Multi-terminal DC Links and Systems: Series parallel and series parallel systems their operation and control. Transient over voltages in HVDC systems OVER voltages due to disturbances on DC side, over voltages due to DC and AC side line faults.

Unit-V
Converter Faults and Protection in Hvdc Systems: Converter faults, over current protection-valve group , and DC line protection Over voltage protection of converters, surge arresters.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Reference Books

1. I. E.W. Kimbark: Direct current Transmission. Wiely Inter Science —New York.
2. J. Arillaga HVDC Transmission Peter Peregrinus ltd. London UK 1983.
3. KR Padiyar : High Voltage Direct current Transmission Wiely Eastern Ltd New Delhi— 1992.
4. E.Uhlman: Power Transmission by Direct Current . Springer Verlag, Berlin Helberg. 1985.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
DISTRIBUTION AUTOMATION

Course Code: GR14D5061 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Distribution Automation and the Utility System: Introduction to Distribution Automation (DA), Control system interfaces, Control and data requirements, Centralized (Vs) Decentralized control, DA System (DAS), DA Hardware, DAS software.

Unit-II

Distribution Automation Functions: DA capabilities, Automation system computer facilities, Management processes, Information management, System reliability management, System efficiency management, Voltage management, Load management.

Unit-III

Communication Systems for DA: DA communication requirements, Communication reliability, Cost effectiveness, Data rate Requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow.
Communication systems used in DA :Distribution line carrier (Power line carrier), Ripplecontrol, Zero crossing technique, Telephone, Cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite. Fiber optics, Hybrid Communication systems, Communication systems used in field tests.

Unit-IV

Technical Benefits: DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, improved operation, Function benefits, Potential benefits for functions, and function shared benefits, Guidelines for formulation of estimating equations Parameters required, economic impact areas, Resources for determining benefits impact on distribution system, integration of benefits into economic evaluation.

Unit-V

Economic Evaluation Methods: Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives. Economic comparison of alternate plans, Classification of expenses and capital

expenditures, Comparison of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Books

1. IEEE Tutorial Course "Distribution Automation".
2. IEEE Working Group on "Distribution Automation".
3. Control and Automation of Electrical Distribution Systems, James. Northcote – Green Robert Wilson, CRC Press.
4. Electric Power Distribution Automation,Dr.M.K.Khedkar, Dr. G.M.Dhole, University Science press.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
ENERGY CONSERVATION SYSTEMS

Course Code: GR14D5042 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
Photo voltaic power generation -spectral distribution of energy in solar radiation- solar cell configurations- voltage developed by solar cell- photo current and load current- practical solar cell performance- commercial photo voltaic systems- test specifications for PV systems- applications of super conducting materials in electrical equipment systems.

Unit-II
Principles of MHD power generation- ideal MHD generator performance- practical MHD generator- MHD technology. Wind Energy conversion: Power from wind- properties of air and wind- types of wind Turbines- operating characteristics.

Unit-III
Tides and tidal power stations- Modes of operation- tidal project examples- turbines and generators for Tidal power generation. Wave energy conversion: properties of waves and Power content- vertex motion of Waves- device applications. Types of Ocean thermal energy conversion systems Application of OTEC systems Examples..

Unit-IV
Miscellaneous energy conversion systems: coal gasification and liquefaction- biomass conversion- geothermal energy- thermo electric energy conversion- principles of EMF generation- description of Fuel cells- Co-generation and energy storage- combined cycle co-generation- energy storage. Global energy position and environmental effects: energy units- global energy position.

Unit-V
Types of Fuel cells-H2O2Fuel cells- Applications of fuel cells-Batteries- Description of Batteries- Battery application for large power. Environmental effects of energy conversion systems-pollution from coal and preventive measures steam stations and pollution- pollution free energy systems.

Teaching Methodologies

1. White board
2. PPT's
3. Seminars

Text Books

1. "Energy conversion systems" by Rakosh das Begamudre, New age international publishers, New Delhi - 2000.
2. Renewable Energy Resources by John Twidell and Tony Weir, second edition, Espon and Co.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
SOLAR AND WIND ENERGY

Course Code: GR14D5044 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Solar Radiation: Sun as Energy Source, Solar Radiation at The Earth's Surface, Solar Radiation Geometry, Solar Time and Equation of Time, Sun Earth angles, Sun path diagram, Sunshine hours, Measurement of Solar Diffuse, Global and Direct Solar Radiation, Equipments, Estimation of Solar radiation on horizontal and tilted Surfaces, Global Solar radiation data, Indian Solar Radiation data analysis.

Unit- II

Solar Cells: Conversion of Solar energy into Electricity - Photovoltaic Effect, Equivalent circuit of solar cell, Characteristic equation, Open circuit voltage, Short circuit current, Current density, Drift and Diffusion, Dark current, Fill factor, Maximum power point, Power density curve, JV characteristics of solar cell, Series resistance in solar cell, Shunt resistance in solar cell.
Efficiency, Recombination, Quantum efficiency, Variation of efficiency with band-gap and temperature, Efficiency measurements, High efficiency cells, Recent developments in Solar Cells, Role of Nano-Technology in Solar cells.

Unit-III

Solar Photovoltaic System Design: Solar cell array system analysis and performance prediction, Shadow analysis: Reliability, Solar cell array design concepts, PV system design, Design process and optimization: Detailed array design, Voltage regulation, Maximum tracking, Quick sizing method, Array protection.

Unit-IV

Wind Energy Basics: Global circulation, Forces influencing Wind - Pressure gradient force and Coriolis force, Local and Regional Wind systems, Atmospheric Boundary Layer, Atmospheric Stability, Surface Wind, Characteristic variables of wind and other related atmospheric parameters, Wind Data.
Power In The Wind/ Measurement And Instrumentation: Power extracted from wind – stream tube model, linear momentum theory, power coefficient, Betz limit. Extreme winds calculation of theoretical power developed by the wind turbine. Concept of Measurement System, Anemometers, Wind sensing systems, Recording systems, Global Positioning System

Unit-V

Wind Turbines and Sitting: Types, Rotor elements, Horizontal and vertical axis wind turbines, slip stream theory. Calculation of axial thrust and efficiency, Pitch and stall regulation, Lift and drag coefficients, thrust and torque calculations, Tip losses, Characteristics of horizontal axis wind turbines and power curve. Concepts of blade design, Wind pumps. Matching of pump and turbine characteristics. Basic approaches to Siting, Siting in homogeneous terrain and complex terrain.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books/ References

1. SP Sukhatme, Solar Energy - Principles of thermal collection and storage, 2nd edition, Tata McGraw-Hill, New Delhi
2. DY Goswami, F Kreith and JF Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia
3. AL Fahrenbruch and RH Bube, Fundamentals of Solar Cells: PV Solar Energy Conversion, Academic Press, New York, 1983
4. T Bhattacharya, Terrestrial Solar Photovoltaic, Narosa Publishers Ltd, New Delhi LD Partain (ed), Solar Cells and their Applications, John Wiley and Sons, Inc, New York, 1995
5. HS Rauschenbach, Solar Cell Array Design Handbook, Van Nostrand Reinfold Company, New York, 1980
6. Meteorological Aspects of the Utilization of Wind as an Energy Source, Technical Note No 175, World Meteorological Organization
7. EH Lysen, Introduction to Wind Energy, CWD Report 82-1, Consultancy Services Wind Energy Developing Countries, May 1983
8. E Hau, Wind Turbines- Fundamentals: Technologies, Application, Economics, Springer -Verlag Berlin -Heidelbeg, 2000
9. T Burton, Handbook of Wind Energy, John Wiley and Sons

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
GAS INSULATED SYSTEMS

Course Code: GR14D5062 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Introduction to Gis and Properties of Sf6: Characteristics of GIS- Introduction to SF6 - Physical properties-Chemical properties - Electrical properties-Specification of SF6 gas for GIS application - Handling of SF6 gas before use - Safe handling of Sf6 gas in electrical equipment - Equipment for handling the SF6 Gas - SF6 and environment.

Unit-II

Layout of Gis Stations: Advancement of GIS station - Comparison with Air Insulated Substation - Economics of GIS - User Requirements for GIS - Main Features for GIS - Planning and Installation components of a GIS station.

Unit–III

Design and Construction of Gis Station: Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components - Insulation Design for Components - Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

Unit-IV

Fast Transient Phenomena in GIS: Introduction- Disconnector Switching in Relation to Very fast Transients-Origin of VFTO-Propagation and Mechanism of VFTO-VFTO Characteristics- Effects of VFTO-Testing of GIS for VFTO.

Unit–V

Special Problems in GISand Gis Diagnostics: Introduction - particles their effects and their control- Insulating Spacers and their Reliability - SF6 Gas Decomposition - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Book

1. M. S. Naidu," Gas Insulated Substations"- IK International Publishing House.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
EHV AC TRANSMISSION

Course Code: GR14D5063 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems-Inductance and Capacitance of E.H.V. lines – Positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

Unit-II
Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

Unit-III
Electrostatic induction in un energized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Un energized lines. Power Frequency Voltage control and over-voltages in EHV lines: No load voltage – Charging currents at power frequency-Voltage control – Shunt and Series compensation – Static VAR compensation.

Unit-IV
Corona in E.H.V. lines – Corona loss formulae- Attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

Unit-V
Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books

1. EHVAC Transmission Engineering by R. D.Begamudre, New Age International (p) Ltd.
2. HVAC and DC Transmission by S. Rao.

Reference Books

1. Rokosh Das Begamudre,"Extra High Voltage AC Transmission Engineering"– Wiley Eastern LTD., NEW DELHI 1987.
2. Edison,"EHV Transmission line"- Electric Institution (GEC 1968).

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

POWER SYSTEMS SIMULATION LAB-I

Course Code: GR14D5064 L:3 T:0 P:0 C:3
I Year I Semester

Contents

1. Sinusoidal Voltages and Currents
2. Determination of parameters of equivalent circuit of a transformer from OC SC Test data
3. Determination of voltage and power at the sending end, voltage regulation using medium line model.
4. Determination of line performance when loaded at receiving end.
5. Formation of bus Admittance matrix
6. Load Flow solution using Gauss Siedal method.
7. Load flow solution using Newton Raphson method in polar coordinates
8. Load flow solution using Newton Raphson method in Rectangular coordinates
   (a) Optimal dispatch by Iterative Technique using Gradient method
   (b) Optimal dispatch including losses
9. Transient response of an RLC circuit.
10. Three phase short circuit Analysis in asynchronous machine (Symmetrical fault Analysis)
11. Unsymmetrical fault Analysis: LG, LL, LLG Fault
12. ZBus Building Algorithm
    (a) Obtain Symmetrical Components of a set of Unbalanced currents.
    (b) Obtain the original Unbalanced phase voltages from Symmetrical
13. Components.
14. Short circuit Analysis of a power system with 12 buses.
15. Determination of natural oscillations of rotor angle and grid frequency for a given synchronous machine.
16. Obtain the step response of rotor angle and generator frequency of a Synchronous Machine.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

VOLTAGE STABILITY

Course Code: GR14D5065 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I
Introduction to Voltage Stability Definitions: Voltage Stability, Voltage Collapse, Voltage Security; Physical relation indicating dependency of voltage on reactive power flow; Factors affecting Voltage collapse and instability; Previous cases of voltage collapse incidences.

Unit-II
Graphical Analysis of Voltage Stability: Comparison of Voltage and angular stability of the system; Graphical Methods describing voltage collapse phenomenon: P-V and Q-V curves; detailed description of voltage collapse phenomenon with the help of Q-V curves.

Unit-III
Analysis Of Voltage Stability: Analysis of voltage stability on SMLB system: Analytical treatment and analysis.
Voltage Stability Indices: Voltage collapse proximity indicator; Determinant of Jacobian as proximity indicators; Voltage stability margin.

Unit-IV
Power System Loads: Loads that influences voltage stability: Discharge lights, Induction Motor, Air-conditioning, heat pumps, electronic power supplies, OH lines and cables.
Reactive Power Compensation: Generation and Absorption of reactive power; Series and Shunt compensation; Synchronous condensers, SVC s; OLTC s; Booster Transformers.

Unit-V
Voltage Stability Margin Stability Margin: Compensated and un-compensated systems. Voltage Security Definition; Voltage security; Methods to improve voltage stability and its practical aspects.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books

1. "Performance, operation and control of EHV power transmission system"-A.CHAKRABARTHY, D.P.KOTARI and A.K.MUKOPADYAY, A.H.Wheeler Publishing, I Edition, 1995.
2. "Power System Dynamics: Stability and Control" – K.R.PADIYAR, II Edition, B.S.Publications.

Reference

1. "Power System Voltage Stability"- C.W.TAYLOR, Mc Graw Hill, 1994.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

POWER SYSTEM OPERATION AND DEREGULATION

Course Code: GR14D5066 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Optimal Power Flow Introduction: Solution to the optimal power flow-gradient method-Newton's method-Linear sensitivity analysis- Linear programming methods- Security constrained OPF-Interior point algorithm- Bus incremental costs

Unit-II

Power System Security Introduction: Factors affecting power system security-Contingency analysis-Detection of network problems-Linear sensitivity analysis-AC power flow methods-contingency selection-concentric relaxation-Bounding area method

Unit-III

State Estimation In Power Systems Introduction: Power system state estimation- Maximum likelihood Weighted Least squares estimation-Matrix formulation- State estimation of AC network- State estimation by orthogonal decomposition- detection and identification of Bad measurements- Estimation of quantities not being measured- Network observability and pseudo measurements

Unit-IV

Power System Deregulation Introduction: Motivation for restructuring of power systems- Electricity market entities model-benefits of deregulation-terminology-deregulation in Indian power sector-Operations in power markets-power pools-transmission networks and electricity markets.

Unit-V

Available Transfer Capability Introduction methods: of determination of ATC - ATC calculation considering the effect of contingency analysis- Transmission open access and pricing-cost components of transmission system- transmission pricing methods-Incremental cost based transmission pricing.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. A.J.Wood & B.F.Woollenberg- John Wiley Power Generation, “Operation and Control”-2nd edition.
2. P.Venkatesh. B.V.Manikandan, S.Charles Raja- A.Srinivasan, “Electrical power systems: Analysis, security, Deregulation”– PHI 2012.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLEXIBLE AC. TRANSMISSION SYSTEMS

Course Code: GR14D5049 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I
Facts Concepts: Transmission interconnections Power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

Unit-II
Voltage Source Converters: Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, comparison of current source converters with voltage Source converters.

Unit-III
Static Shunt Compensation: Objectives of shunt compensation, midpoint voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable var generation, variable impedance type static var generators switching converter type var generators hybrid var generators.

Unit-IV
SVC and STATCOM: The regulation and Slope transfer function and dynamic performance, transient Stability enhancement and power oscillation damping operating point control and summary of compensator control.

Unit-V
Static Series Compensators: Concept of series capacitive Compensation improvement of transient stability, power oscillation damping Functional requirements GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC) and thyristor controlled series capacitor (TCSC) control schemes for GSC, TSSC and TCSC.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books
1. "Understanding FACTS Devices' N.G. Hingorani and L.Guygi IEEE Press Publications 2000.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

NEURAL AND FUZZY SYSTEMS

Course Code: GR14D5050 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit-II

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Unit-III

Multilayer Feed Forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

Unit-IV

Self-organizing Maps (som) And Adaptive Resonance Theory (art): Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-

Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.
Classical and Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Unit-V
Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.
Applications:
Neural Network Applications: Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting.
Fuzzy Logic Applications: Fuzzy logic control and Fuzzy classification.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books
1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

Reference Books
1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. Bapi Raju, Pearson Education
2. Neural Networks – James A Freeman and Davis Skapura, Pearson, 2002.
3. Neural Networks – Simon Hykins , Pearson Education
4. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
5. Neural Networks and Fuzzy Logic System by Bork Kosko, PHI Publications

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
POWER QUALITY

Course Code: GR14D5051 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Introduction: Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage. Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

Unit-II

Long Interruptions: Interruptions-Definition-Difference between failure, outage, Interruptions-causes of Long Interruptions-Origin of Interruptions-Limits for the Interruption frequency-Limits for the interruption duration-costs of Interruption-Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.

Short Interruptions: Short interruptions-definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping-voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

Unit-III

Voltage Sag Characterization-single Phase: Voltage sag-definition, causes of voltage sag, voltage sag magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, voltage sag duration.

Voltage Sag-characterization-Three Phase: Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

Unit-IV

PQ Considerations In Industrial Power Systems: Voltage sag-equipment behaviour of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

Unit-V

Mitigation of Interruptions and Voltage Sags: Over view of mitigation methods-from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and EMC Standards: Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Book

1. "Understanding Power Quality Problems" by Math HJ Bollen. IEEE Press

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
ELECTRIC SMART GRID

Course Code: GR14D5067 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Introduction: Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

Smart Grid to Evolve a Perfect Power System: Introduction- Overview of theperfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

Unit-II

DC Distribution and Smart Grid AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

Intelligrid Architecture for the Smartgrid: Introduction- Launching intelligrid-Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

Unit-III

Dynamic Energy Systems Concept Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems-Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

Unit-IV

Energy Port As Part Of The Smart Grid: Concept of energy -Port, generic features of the energy port.

Policies and Programs to Encourage end – use Energy Efficiency: Policies and programs in action -multinational - national-state-city and corporate levels.

Market Implementation: Framework-factors influencing customer acceptance andresponse - program planning-monitoring and evaluation.

Unit-V

Efficient Electric End-Use Technology Alternatives Existing technologies-lighting-Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances-Ductless residential heat pumps and air conditioners-Variable refrigerant flow air conditioning-Heat pump water heating-Hyper efficient residential appliances-Data center energy efficiency- LED street and area lighting-Industrial motors and drives-Equipment retrofit and replacement-Process heating-Cogeneration, Thermal energy storage-Industrial energy management programs-Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. Clark W Gellings, “The Smart Grid, Enabling Energy Efficiency and Demand Side Response”- CRC Press, 2009.
2. Janaka Ekanayake, Kithsiri Liyanage,Jianzhong. Wu, Akihiko Yokoyama, Nick Jenkins, “Smart Grid: Technology and Applications”- Wiley, 2012.
3. James Momoh, “Smart Grid :Fundamentals of Design and Analysis”-Wiley, IEEE Press, 2012.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
HIGH VOLTAGE ENGINEERING

Course Code: GR14D5068 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Introduction To High Voltage Engineering Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

Unit-II

Break Down In Dielectric Materials Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

Unit-III

Generation & Measurement Ofhigh Voltages & Currents Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

Unit-IV

Over Voltages & Insulation Co-ordination Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Unit- V

Testing Of Materials & Electrical Apparatus Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, and Radio Interference measurements.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition
2. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition.

Reference Books

1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3. High Voltage Engineering, Theory and Practice by Mazen Abdel Salam, Hussein Anis, Ahdan El-Morshedy, Roshdy Radwan , Marcel Dekker.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
REACTIVE POWER COMPENSATION AND MANAGEMENT

Course Code: GR14A5069 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Load Compensation: Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.

Unit-II

Steady-State Reactive Power Compensation In Transmission System: Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation –examples

Transient State Reactive Power Compensation In Transmission Systems: Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples.

Unit-III

Reactive Power Coordination: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

Unit-IV

Demand Side Management: Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels

Distribution Side Reactive Power Management: System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks

Unit-V

User Side Reactive Power Management: KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations

Reactive Power Management In Electric Traction Systems And Are Furnaces: Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic

operations-furnaces transformer-filter requirements-remedial measures-power factor of an arc furnace

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Books

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982 (Units I to IV)
2. Reactive power Management by D.M.Tagare,Tata McGraw Hill,2004.(Units V toVIII)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
POWER SYSTEM RELIABILITY

Course Code: GR14D5070 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Generating System Reliability Analysis -I: Generation system model capacity outage probability tables Recursive relation for capacitive model building sequential addition method unit removal Evaluation of loss of load and energy indices Examples.

Unit-II

Generating System Reliability Analysis-II: Frequency and Duration methods Evaluation of equivalent transitional rates of identical and non-identical units Evaluation of cumulative probability and cumulative frequency of non-identical generating units 2- level daily load representation - merging generation and load models Examples.

Unit-III

Operating Reserve Evaluation: Basic concepts - risk indices PJM methods security function approach rapid start and hot reserve units Modelling using STPM approach.

Bulk Power System Reliability Evaluation: Basic configuration conditional probability approach system and load point reliability indices weather effects on transmission lines Weighted average rate and Markov model Common mode failures.

Unit-IV

Inter Connected System Reliability Analysis: Probability array method Two inter connected systems with independent loads effects of limited and unlimited tie capacity - imperfect tie Two connected Systems with correlated loads Expression for cumulative probability and cumulative frequency.

Distribution System Reliability Analysis-I (Radial configuration): Basic Techniques Radial networks Evaluation of Basic reliability indices, performance indices load point and system reliability indices customer oriented, loss and energy oriented indices Examples.

Unit-V

Distribution System Reliability Analysis - II (parallel Configuration): Basic techniques inclusion of bus bar failures, scheduled maintenance temporary and transient failures weather effects common mode failures Evaluation of various indices Examples.

Substations and Switching Stations: Effects of short-circuits - breaker operation Open and Short-circuit failures Active and Passive failures switching after faults circuit breaker model preventive maintenance exponential maintenance times.

Teaching Methodologies:

1. White board
2. PPTs
3. Seminars

Reference Books

1. Reliability Evaluation of Power Systems by Roy Billinton and Ronald N. Allan, Plenum press, New York and London (Second Edition), 1996.
2. Reliability Modeling in Electric Power Systems by J. Endrenyi, John Wiley and Sons, 1978. (First Edition)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
MICROCONTROLLERS

Course Code: GR14D5048 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Introduction and 8051 Architecture: Introduction to micro controllers, comparing micro processors and micro controllers, 4,8,16 and 32 bit micro controllers, Development systems for Micro controllers, Architecture; Architecture of 8051, pin configuration of 8051 micro controller, hardware input pins, output pins ports and external memory, counters and timers, serial data input and output and interrupts.

Unit-II

Moving Data and Logical Operations: Introduction, Addressing modes, External Data moves, Code Memory Read-only Data Moves, PUSH and POP Op codes, Data Exchanges, Logical Operations; Byte-Level Logical Operations, Bit-Level Logical Operations, Rotate and Swap Operations.

Unit-III

Arithmetic Operations, Jump and Call Op codes: Introduction, Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Jump and Call op codes; The jump and call program range, Jumps, Calls and Subroutines, call and returns, Interrupts and Returns.

Unit-IV

8051 Microcontroller Design: Introduction, micro controller specification, micro controller Design, Testing the Design, Timing sub routines, Lookup Tables for the 8051, Serial Data Transmission.

Unit-5

Applications and Serial Data Communication: Introduction, Key boards, Displays, Pulse Measurement, D/A and A/D Conversions, Multiple Interrupts, Serial data Communication; Network Configurations, 8051 Data Communication Modes.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. "The Intel Microprocessors" Architecture Programming &Interfacing by Barry b Brey.
2. Advanceed Microprocessors by kenrith J Ayala, Thomson publishers.
3. Microcontrollers by kentrith J ayala, Thomson publishers.

Reference Books

1. Microprocessors & Interfacing Programming & Hard ware by DOUGLAS V.Hall
2. Microprocessors & Microcontrollers by Prof. C.R.Sarma

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

POWER SYSTEMS LAB-II

Course Code: GR14D5071 L:0 T:0 P:3 C:2
I Year II Semester

Content:

1. Tripping Characteristics of an MCB of 1Ampere rating
2. Characteristics of fuse wire
3. Testing of Instantaneous Over Current relay
4. Current time Characteristics of Induction Disc type relay
5. Characteristics of Bimetallic Thermal Over Load relays
6. Testing of Transformer differential relay
7. Model of a Transmission Line with Lumped Parameters
8. Power Factor Correction systems
9. Over Voltage/Under Voltage Relay testing
10. Distance protection
11. Directional Over Current relay